Here is my model that shows
you a lot of the details of an antibody's function and how it structure
interacts with antigen. Having said that, I
would like to say that this is a good model for
showing some things, and there are plenty of
other models that will also illustrate many of the
properties of the antibody. This one is a really good one for analyzing how the
structures fit together. If you want to see what
it really looks like, you need a space
filling molecule. Those models tend to be a
lot harder to interpret. Let's just take a look at this model carefully and
see what we can learn about antibodies generally before we start looking into
the specifics of how you put together the chains and how that
affects the various functions. First of all, what we've got in this antibody is
the light chain is here and light
blue and hot pink, and here on the other side, and it turns out
in any antibody, these two will be identical. Let's mark this. Light chain. Here
we come into, again, one of those peculiarities of the terminology that
you have in immunology. A lot of times a peptide
is called a chain. I never heard of that usage
in any other context, but the word chain
simply means peptide. If I have an antibody here, what I have is a quaternary
association
of four peptides, two light chains, and two heavy. In this model, the heavy
chain starts here, comes down through, and then here is the part of the heavy
chain in the
stem so that in this case, the FC region that we isolated before is this region
here, the bottom part. The fab fragments will
be the whole light arm. I would get one fab fragment here and one fab fragment
here. Again, a fab two fragment
would be from here up, and this part would be the
FC fragment from here down, depending on where you
clipped it exactly. Now, if you look at this, you can see that the light chain
is made up of
two immunoglobulin domains, one that I've done in light blue and one that I've
done in pink. This particular heavy
chain is made up of 1, 2, 3, 4 immunoglobulin of domains, and a bendy region in
between. This is a hinge region
that can flop around. In other antibodies,
there will be another, we'll see, immunoglobulin
domain here, and it'll be more rigid. Now, in both of these, I have done
sections
of the antibodies in blue and dark blue. But I've done this part
of the antibodies, whether they're the heavy part
chain or the light chain, I've done in pink and yellow with a little
touch of green. Why did I do that? This part in here, the pink yellow parts
with the green, are the variable domains. The loops that stick
out here, 1, 2, 3, will be loops that
contact the antigen. That this part of the
antibody here is more or less constant from
antibody to antibody. There are some differences. The differences are not
trivial, but in general,
these don't change. Whereas when I look at
this part of the antibody, I find it's variable. In truth. This part from here
to here is
not all that variable. What's going to be
really variable are the loop regions in here. But let's take another
backup look here. We can see the
immunoglobulin domains because we can see the
bread and butter sandwich. I'm hoping you can catch that. I will put another
picture of this in your notes in detail
to look at it. You can see that I have used these cute sequence to designate
the disulfide linkages. Then somewhere in here, forcing these two heavy
domains apart in the FC, I have some white fuzzy stuff. This stands for the

two oligosaccharides that are attached to the
second domain from the end. This is a smallish carbohydrate. It is hooked on
here, and it helps to pull apart
this part of the FC stem. It's going to be very important in signaling
to other parts of the immune system just how to treat whatever this antibody
is hooked up against. We've got, again,
here's our light chain, molecular weight about 50,000. Here is the heavy chain,
molecular weight about 100,000. Here are the sequence
indicating disulfide bonds. Some of them are part of the bread and butter
sandwich domains that hold this together. Others here, here, here are holding
together the
light and heavy chains, and the two heavy
chains together. That's stabilizing this. Again, we have a carbohydrate
as part of the FC stage. This will give you
an overview of what the antibody's different parts
are and how they relate. We're going to look
at just how you make these funny color
regions when we look at gene rearrangement, but we can hold that for now. What I
want to do now is take a closer look at just
this light chain. That's Part D.
Here's our antibody, and here is the light chain. This is what we need to
enlarge. This shows you very clearly the two domains of the light
chain or light peptide. The constant region here in blue is a typical
immunoglobulin domain with Beta plated sheets
arranged so that the hydrophobic
side chains are in the interior and the hydrophilic
are on the exterior. This is, of course, stabilized
by the disulfide bond. This forms the base of the arm that connects to
the hinge or bend in the y. That will be attached
to the heavy chain by another disulfide
bond at this region. This will anchor this and
the replace of the y part of the antibody where
you either have the rigid bend region or the
very flexible hinge region. There are two different genes that code for the
light chain. One of them is the Kappa and
the other is the Lambda, and they differ somewhat
in the constant region, but all versions have a
very similar structure, and nobody has identified
any functional differences. Any one antibody will have either two Kappas or
two identical Lambdas. Any one cell will decide
which of its genes it's going to use and we'll make that
for the rest of its lifespan. The variable region is also
in immunoglobulin domain, and it has two extra
loops shown here. It will also be stabilized
by a disulfide bond. Most of this domain is
not all that variable, and it really serves as
a scaffolding to extend the recognition
region out at the tip of the arms of the
y of the antibody. The three loops that extend from the arm are highly variable
and help determine in combination with three
comparable loops on the heavy chain the
specific antigen that this antibody will bind to. Note that these are on the
amino terminal
end of the peptide. Thus, the ribosome translates
this end first and continues until
it finishes up at the carboxyl end of
the constant region. Here's a combination ribbon
and space filling model that shows the light
chains in hot pink. You can see the
recognition loops here. The heavy chain is in yellow, and we'll discuss that
in the next clip.